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ABSTRACT

The Instructional Systems Development (ISD) approach for the accomplishment of vocational training programs provides a methodology for gathering and analyzing job information, for developing instructional materials and media, for conducting instruction, and for evaluating and improving the effectiveness of training programs. Included in the ISD procedural model are the following five phases: analysis (establishment of what constitutes adequate job performance); design (development of terminal and enabling learning objectives based upon job performance measures); development (identification of appropriate learning activities, selection of media, and development of instructional materials); implementation (identification and correction of any discrepancies or deficiencies in the total training program and also completion of all necessary staff training procedures); and control (evaluation of the operational effectiveness of the program as a dynamic interrelated entity). Appendixes to this report contain a glossary, a job performance measure, a learning objective analysis worksheet, a glossary of action verbs, a training program planning worksheet, and a guide for evaluating instruction. (MN)

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A SYSTEMS APPROACH TO THE PREPARATION AND CONDUCT OF TRADE AND INDUSTRIAL TRAINING

Presented at

American Vocational Association

1982 Convention

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Preface

This paper was written for those who plan, develop, teach, administer or manage vocational education and training programs. It describes an Instructional Systems Development (ISD) Model which the author has found to be practical and effective based on his experience with its application by the U.S. and Royal Saudi Navies. The purposes for this paper are to:

- save the reader from locating and reading voluminous publications on the topic of ISD
- shorten what is written into a digest useful as a general reference
- simplify what is written on the topic
- provide the reader with a basic understanding of ISD
- introduce the reader to an approach for the development and accomplishment of vocational training which is effective and efficient, available in cook book form, and is useful in standardizing curriculum development efforts.

There is nothing really new about Instructional Systems Development procedures. As procedures they are broadly accepted and have been used by the military for a number of years. Nor is Systems Development a catchword to suggest something new; at most it is a process for doing something better -- better in deliberately attempting to be systematic, analytic and comprehensive. The U.S. Government spent millions to establish ISD and the entire process is documented and available through the government publications listed in the references.[1]

If after reading this paper, you find the ISD approach acceptable, there is a large selection of fully developed and validated competency based courses prepared by the U.S. Navy and Air Force using this methodology "on-the-shelf" and available for use. These courses have been packaged and are distributed on a non-profit basis by the U.S. Naval Institute, Annapolis, Maryland, and the Aerospace Education Foundation, Washington, D.C. Additional military developed instructional materials are maintained in a special library at the National Center for Research in Vocational Education at the Ohio State University for use by visiting vocational educators and trainers.

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[1] Various passages in this paper are paraphrased from government publications listed in the references. These public domain sources offer excellent guidance in applying the ISD process.

Course packages contain public domain printed material including texts, workbooks and programmed units, a complete set of instructor materials including a "Plan of Instruction" that specifies all learning objectives. Each package also includes a summary of key elements including a list of equipment essential to the course, plans and parts lists for many of the special devices used in demonstrations and laboratory experiments which form part of the system designs. All non-copyright audiovisual elements utilized in the presentation of a course are included in each package.

Each one of these course packages is the product of thousands of hours of painstaking and highly thoughtful labor on the part of special teams, skilled in the techniques of ISD. Curriculum development, starting from scratch, may cost in excess of $4000 per hour of instruction, according to Office of Education estimates. The job can be done, through the adaptation of military materials, for a fraction of such costs. As a matter of fact, current costs to collect and process materials from a typical military course are approximately $50 per hour of instruction. The cost of reproducing these materials, and placing them in civilian classrooms, is approximately $10 per hour of instruction. The point here is that the use of such materials as a course or as resources in developing a course can substantially reduce the cost of producing a competency based program while facilitating the early availability of instructional materials.

It is important to avoid the possible misconception that these materials are a neatly wrapped package ready for purchase and immediate use by a civilian secondary or post-secondary school population. They must, of course, be edited, refined or revised to meet local needs in order to assure the desired results/outcomes.

Regardless of how good the course package may be, it is important that instructors be involved in adapting or localizing the instructional materials. Such involvement will not only provide a better teaching/learning climate, but also guarantee that the materials are implemented because the instructor has a feeling of authorship. In order for this element of involvement to occur, instructors should thoroughly understand what ISD is all about -- that it is not an end in itself, but a means to efficient and effective learning.

Clifton P. Campbell

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Introduction

In training youth and retraining displaced workers for demand occupations or helping business and industry apply new technology, vocational training has the potential to be a powerful change agent. But before such potential can be fully realized, training programs must become accountable[1] for their effectiveness and adequacy.

After years of debate by leaders in the field, there is still no consensus on the best course of action for achieving program accountability. However, many experts see cause for optimism in an approach borrowed from government and industry. This approach is called Instructional Systems Development (ISD). By definition, ISD is a deliberate and orderly process for planning, developing, implementing and evaluating training programs which ensures that trainees are taught the knowledge, skills and attitudes essential for successful job performance.

The accountability of vocational training programs is virtually certain when the principles and processes of ISD are used. This is because the derivative and iterative character of the methodology ensures, when its procedures are faithfully carried out, that instruction meets job requirements.

Parts of this methodology are not unique to ISD and have been used by vocational trainers and educators for some time. Their application was often fragmentary, however. The critical difference, then, is an emphasis on the relationship between the parts rather than on the parts themselves.

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[1] Accountability is essentially a form of the concept of management by objectives used by business and industry. Individuals and programs are evaluated to determine how well they are accomplishing the objectives for which they are responsible.

Overview

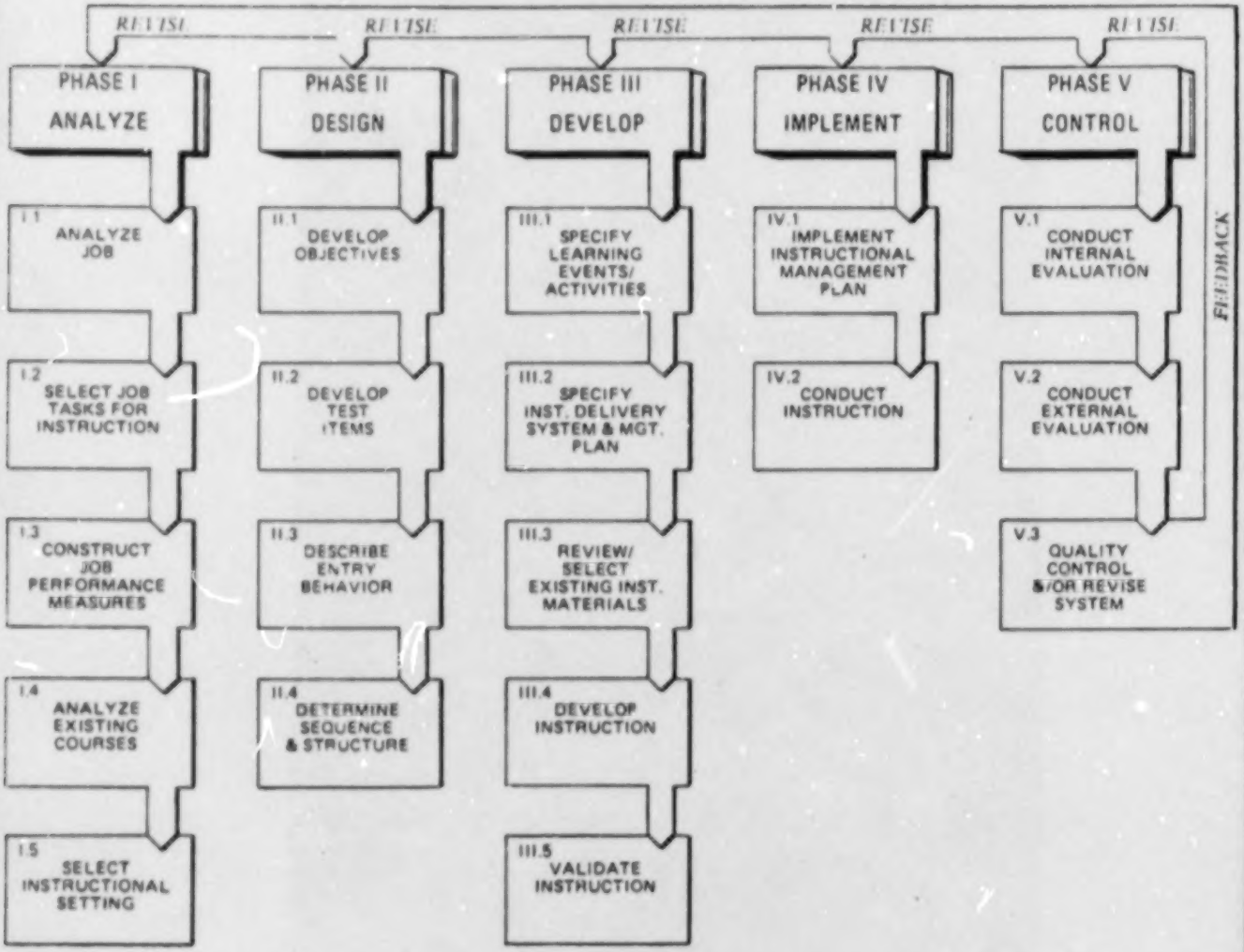
The ISD approach for the development and accomplishment of vocational training programs provides a methodology for gathering and analyzing job information, developing instructional materials and media, conducting instruction and evaluating and improving the effectiveness of training programs. This approach is based upon evidence that the tasks performed on a job can be identified and analyzed and that learning objectives and instructional strategies to achieve these objectives can be developed and structured so that instruction will be efficiently and effectively conducted. (CNTT-A10, 1976, p. 2-i)

The procedural model and flowchart for ISD is comprised of five phases: I) Analyze, II) Design, III) Develop, IV) Implement and V) Control. Figure 1 shows these phases, each of which is made up of steps. Symbolically, this structure illustrates the recommended relationship of the five phases and nineteen procedural steps. It also provides a graphic portrayal of the interrelationships between all the phases and steps which form a closed loop instructional system. Components of the model are necessarily depicted in a linear sequence. In practice, some of the steps can be conducted concurrently, while others must be done sequentially.

A descriptive digest of each phase of the ISD model is provided under the following headings. These descriptions were prepared based on a review, analysis and synthesis of the documents used by U.S. Government agencies as procedural guides for ISD. These documents are cited in the reference list at the end of the paper.

Phase I, Analyze

The first procedural step in the ISD process is to establish what constitutes adequate job performance. Job analysis is the basic method for identifying and describing the tasks and elements of tasks which are necessary



INSTRUCTIONAL SYSTEMS DEVELOPMENT MODEL AND FLOWCHART

Figure 1

to perform a clearly defined, specific job. It can involve any or all of the techniques of questionnaire surveys, jury of experts, personnel interviews and observations at the work site, and reviewing job task lists from occupational surveys. Regardless of how well the following procedural steps are carried out, if job analysis data are not valid and reliable, the training program will fail to produce graduates who can perform successfully on the job. (NAVEDTRA 106A, Phase I, 1975, p. 1)

Some of the tasks identified will seldom be required on the job and only minimum job degradation would result if they were not performed. However, other tasks may be highly critical to successful job performance, and the complex nature of the task makes instruction essential. Economic, time, feasibility and other considerations require a decision as to which tasks are selected for instruction and which are not. Those selected become the basis of the training program; those rejected are not reconsidered until the external evaluation step in Phase V. Task selection criteria and information collected during the job analysis are used in making this important decision. (AFP 50-58, Vol. II, 1978, pp. 2-16 & 2-17)

Job performance measures are constructed for those tasks selected for instruction. These tests evaluate task proficiency under actual work conditions and standards. They are validated at the work site if resources and time permit. If not, accuracy of the job performance measure must be verified by subject matter specialists. Job performance measures are a means of keeping training faithful to job requirements and serve as a connecting link between the tasks and the learning objectives. Therefore, the behaviors, conditions and standards of the job performance measure resemble those of the actual task as closely as practical.

In addition to evaluating a job incumbent's task proficiency, job

performance measures are used in formulating learning objectives (step II.1), in writing test items (step II.2) and in evaluating the performance of graduates on the job (step V.2). Because of their multiple uses, job performance measures are fundamental to the development and control of instruction. However, while worthwhile, considerable effort is involved in constructing these measures. (NAVEDTRA 110, 1978, p. 13)

In order to avoid unnecessary duplication of effort, existing course documentation and other available material should be examined. This effort may reveal that all or portions of the analysis and other phases have already been done by someone else.

As a final step in phase I, the tasks selected for instruction are analyzed in order to identify the most appropriate instructional setting(s), e.g., classroom and/or shop instruction, on-the-job training, etc. (MIL-STD-1379A, 1976, p. 5) The optimal setting is the one that provides the necessary equipment, facilities and personnel as well as the most effective and efficient instruction. It should be noted, however, that settings are usually selected by higher authority and trade-offs, among competing alternatives, are frequently made based on resource availability and other constraints. See Figure 1 for a list of the steps described in this phase of the ISD model.

Phase II, Design

The first three steps in phase I, generally referred to as front end analysis, focused primarily on job performance requirements. Phase II represents a shift in focus and step II.1, Develop Objectives, is the first step in designing training to meet job performance requirements. From this point on, instructional design and development will be carried out with respect to the objectives rather than the job tasks.

Learning objectives (both terminal and enabling) must realistically

describe the knowledge and skills that are to be attained by the trainee. They provide a definitive statement of the behavioral actions, performance conditions and attainment standards which can be measured within the learning and testing setting.[2] Terminal learning objectives are formulated for all tasks selected for instruction. Job performance measures provide a basis for their development. (Application of a System, 1969, pp. 1 & 3)

Each terminal learning objective is subjected to a hierarchical analysis to derive intermediate (enabling) objectives. These enabling objectives provide the level of detail necessary to specify the behavioral elements and the skills and knowledge that mediate a terminal objective. (Vineberg & Joyner, 1980, p. xii) In some cases the resultant enabling objectives will be the same as the elements of the task itself.

Learning objectives bridge the gap between performing a task under job conditions and learning how to perform that task in an instructional setting. Precisely developed learning objectives become the goals for training and serve as a control over the content and output of instruction. They define for the trainee, instructor, curriculum developer and test writer exactly what is required of them. (NAVEDTRA 106A, Phase II, 1975, p. 1)

After all the learning objectives have been prepared, test items to measure trainee attainment are written. These test items are called criterion referenced measures because they test the required behavioral actions against

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[2]The development of acceptable behaviorally stated performance objectives usually proves to be one of the most troublesome steps in ISD. Yet, more is known about this step than many of the others, and thus, more has been written about what should be done. What appears to be needed is management support for the time, personnel and other resources required to properly formulate objectives and the implementation of quality assurance measures.

the criteria for successful performance that were identified in the objectives.[3] With a criterion referenced measure, trainees are rated on their ability to attain the objectives. How others score on a test has no bearing on an individual's grade. (AFP 50-58, Vol. III, 1978, p. 1-2) The nature of a learning objective determines the type of criterion test item needed; thus, paper and pencil items are used to assess knowledge, performance items are used to evaluate motor skills, and so on. Sufficient test items should be written for all learning objectives so that alternative forms, not just scrambled versions, of a test can be prepared for retesting. Where objectives are the same as the job requirements, tests may be similar or identical to the job performance measures constructed earlier. The grouping of test items into pre-tests, progress tests and a post-test is done in step II.4.

Once the test items have been written, those that were designed for lower level enabling objectives should be administered to a representative sample of the trainee population, in the form of an entry level test, to measure entry level behavior. Entry level behavior includes the skills, knowledge and attitudes trainees possess at the time they report for instruction. (Curriculum Writer's Guide, 1980, p. 33) Estimates of trainee capabilities will be verified or adjusted according to test results. When the test shows that some of the enabling objectives, upon which test items are based, have already been mastered, those enabling objectives and their corresponding test items are deleted from the training program. Whenever the test indicates that trainees lack prerequisite knowledge and skills, additional learning objectives and test items must be developed to fill the gap between entry level assumptions and the true entry

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[3] It is explicit in ISD that test items are written for learning objectives rather than from the subject matter as is the practice in some other instructional approaches.

level required. No modifications are necessary when the test accurately measures the trainees' entry level behavior.[4] Entry level behavior may also be determined by testing the actual trainees before instruction begins.

The next step is to determine and specify how the terminal objectives and their respective enabling objectives will be sequenced and structured. These decisions are made as much as possible on the basis of learning factors rather than administrative factors or past experience. However, given the inadequacy of knowledge about how different sequencing strategies affect learning and the difficulty of estimating transfer of learning, these decisions must be based in part on judgment.

Objectives are first categorized as dependent, independent or supportive (those between which some transfer of learning occurs). The dependent objectives are then sequenced in accordance with the existing hierarchy of skills and knowledge so that prerequisite learning occurs first. Next, supporting objectives are placed as close to each other as possible without interfering with the dependent sequencing. Independent objectives are sequenced last in accordance with such principles as simple to complex, familiar to unfamiliar, the same order as performed on the job, or any other order that is practical. Identical learning objectives are deleted and those with identical actions are grouped together so that each is taught only once. (NAVEDTRA 110, 1978, pp. 96-98)

To the extent that seems reasonable, the sequenced learning objectives are grouped into units, blocks of instruction or other organized and manageable sets of objectives in the way they will be presented to trainees. Grouping is

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[4] Results for each test item will probably show that some trainees already know the material while others do not. It is unlikely that everyone tested will either know all of the material or not know it. Therefore, in establishing an entry level for a group paced program, curriculum developers must use their best judgment in determining the exact level of instruction at which to begin.

an arbitrary matter based on rational judgments regarding commonality of subject matter and anticipated transfer of learning. Other criteria for grouping objectives include: meaningful relationships, and a natural beginning and ending. (AFP 50-58, Vol. IV, 1978, p. 2-5)

Because test items measure specific learning objectives, they are structured at the same time as the learning objectives. This greatly facilitates the grouping of test items into pre-tests, progress tests and a post-test. The steps in the design phase and their sequence are illustrated in Figure 1.

Phase III, Develop

The development phase begins by identifying the learning activities which must take place in order to produce the desired learning outcomes. In later steps, media will be selected and instructional materials developed to support these activities. The procedure for identifying learning activities is: 1) classify learning objectives according to the appropriate learning categories and sub-categories, 2) select the learning guidelines for each sub-category, and 3) convert each learning guideline into learning activities specific to the learning objective.

Table 1 shows four learning categories: mental skill, information/knowledge, manual/physical skill and attitude. Each of these categories is further divided into appropriate sub-categories so that more specific learning activities can be specified.

A learning objective is first classified into one of the categories and then assigned to a sub-category. (NAVEDTRA 106A, Phase III, 1975, p. 11) The learning objective must have complete action statements, conditions and standards in order to facilitate correct sub-category assignment. Once the sub-category has been determined, those learning guidelines necessary for optimum learning to take place are selected. Learning guidelines are statements which specify

Table 1

Learning Categories, Sub-Categories and Guidelines

Learning Categories	Learning Sub-Categories
1. Mental skill	1.1 Rule learning and using 1.2 Classifying-recognizing patterns 1.3 Identifying symbols 1.4 Detecting 1.5 Making decisions
2. Information/knowledge	2.1 Recalling bodies of knowledge
3. Manual/physical skill	3.1 Performing gross motor skills 3.2 Steering and guiding-continuous movement 3.3 Recalling procedures, positioning movement 3.4 Voice communicating
4. Attitude	4.1 Attitude learning

Learning Guidelines

Specify learning objectives. Trainees attain most objectives better when they understand what they are expected to learn. Therefore, learning objectives should be specified in instructional materials and/or stated at the beginning of a lesson.

Provide active practice. Trainees learn faster, better and retain what is learned when they actively practice new learning. Therefore, learning activities should call for active practice and drill. Whenever possible trainees should do something to show they understand the subject matter.

Provide guidance and prompts. Give trainees sufficient examples of what to do and explanations of how to do it so that they know what is expected of them. Guidance before and during early performance can assist in relating new learning to past learning and in focusing attention on cues to watch for during the performance.

Provide feedback. In order for practice to be as effective as possible, trainees need to have feedback relative to their performance. Feedback should indicate what a trainee is doing right, what is wrong and how performance can be improved. Tests should be used as teaching tools by fairly testing the learning objectives and by providing reinforcement for correct answers or an explanation for mistakes.

learning events and activities. Some guidelines are appropriate for a variety of learning objectives and should be considered in identifying the learning activities. Four such guidelines are presented in Table 1 (specify learning objectives, provide practice, guidance and feedback). Other guidelines, however, are unique to each learning sub-category and require different instructional treatment. For example, information is not learned the same way as a manual skill. (NAVEDTRA 106A, Exec. Summary, 1975, p. 66-69)

A list of learning guidelines for each of the eleven learning sub-categories is provided in NAVEDTRA 106A, Phase III, pages 35-70. From these lists, which are based in part on learning theory and in part on practical experience, the most appropriate guidelines are selected for each of the learning objectives according to its sub-category. The learning objective action statement, conditions and standards developed in step II.1 and the test items from step II.2 are used, along with judgment, as the criterion for selection. The purpose then

learning objective. Using the selected learning guidelines, the learning objectives and test items, it is possible to identify what the instructor or instructional materials must do in order to provide training as directly related to task performance as possible (e.g., provide two opportunities to dissemble the carburetor). (NAVEDTRA 110, 1978, p. 106) The learning guidelines and activities specified in this step are important in carrying out the following step as well as others in Phase III.

The procedures in step III.2 result in two products. The first is the specification of an instructional delivery system which provides the optimal combination of instructional methods, media and organizational system to

accomplish the terminal objective.[5] However, since there is no single best method of teaching which applies to all learning situations or objectives, the instructional delivery system will normally include a combination of teaching methods, instructional media and a system of organizing students and instructors to accomplish an objective. The selection of one delivery system over another, therefore, is made on the basis of careful analysis of the instructional situation from several standpoints: 1) learning objectives, 2) course content, 3) characteristics of the trainee population, 4) instructional staff, 5) space, 6) equipment and facility constraints, 7) instructional materials, 8) time and 9) cost advantages or disadvantages of each delivery system. Consequently, the instructional delivery system must be compatible with the learning objectives selected in step II.1, the learning activities identified in step III.1 and any other significant inputs from previous steps in the model. (Braby, Henry, Parrish & Swope, 1969, pp. 7 & 8)

The second product of step III.2 is an instructional management plan. This plan consists of the policies and procedures used in organizing, controlling and evaluating the delivery of instruction. This plan indicates exactly how the training program is to be conducted, how the trainees are to be managed, when and where they will be tested, what the instructors and other support personnel are to do and how each of the many elements within the plan work together. Documents that are a part of the management plan specify the procedures to be used in scheduling, instructing, monitoring and evaluating both the trainees and instructors, and whatever else is needed to operate the training program. (NAVEDTRA 110, 1978, p. 189)

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[5]The choosing of an optimum instructional delivery system for various learning objectives is a subtle and complex decision making task; something that cannot be fully proceduralized as evidenced by the limitations of existing techniques.

Developing instructional materials is an expensive activity. The costs are those of both time and money. Therefore, it is essential to search out and consider the suitability of existing items before committing resources to the development of new instructional materials. (AFM 50-2, 1979, p. 5-13) Candidate materials should be reviewed to determine their appropriateness to previously specified objectives, learning guidelines and activities, methods and media. Existing materials that are nearly, but not entirely, adequate may be adapted for use. (Handbook for Implementation, 1979, p. 11) It is evident that professional judgment is the dominant factor in the review and selection of existing instructional materials.

In step II.1, learning objectives were prepared for each task selected for instruction. In step III.1, learning guidelines and learning activities were specified. From step III.2 the media and methods of instruction have been identified and from step III.3 suitable off-the-shelf instructional materials were assembled. At this point all the preceding analysis and planning will be utilized to produce the necessary additional instructional materials.[6]

The actual authoring process consists of writing or developing many different types of instructional materials: scripts, slide/tape presentations, video tapes, programmed texts, instructional packages, job performance aids, and so forth. Initially, these materials should include only the bare minimum of instruction, which will be augmented as needed for trainees to attain the learning objectives. This prevents the inclusion of extraneous material which could be incorporated if an attempt were made to be comprehensive. Instructional

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[6]It is explicit in the ISD approach that learning objectives are prepared for every job task selected for instruction and that these learning objectives are the basis for the selection and development of all instructional materials used in the training program. Objectives are not derived from existing subject matter as is the practice in some other approaches.

materials are reviewed by a colleague as they become available. Then they are tried out on one representative learner at a time with revisions made as necessary. This progression assures the economies of minimal instruction and the correction of discrepancies. Quantitative information about the effectiveness of instruction is obtained through validation procedures which provide further opportunities for revision. (CNTT-A10, 1976, p. 3-86)

Validation procedures include both individual and group trials by selected members of the trainee population or representative learners. First, instructional materials are individually tried out on two to five trainees, revised and tried out again until consistent problems and errors are removed. Then group trials are conducted until it is proven that the trainees can attain the learning objectives as measured by criterion referenced tests. (AFP 50-58, Vol. I, 1978, p. 1-4) At this point instructional materials are ready for quantity reproduction and implementation. When instructional materials are put into use before validation trials are completed, continual revision with the actual trainees may be required. Figure 1 lists the five steps which make up the development phase.

Phase IV, Implement

The implementation of the instructional management plan developed in step III.2 is the terminal step in planning and preparation and occurs before trainees arrive and instruction begins. It is at this point that any discrepancies or deficiencies in the materials, procedures, tests and other necessary components of the total training program are identified and corrected. (NAVEDTRA 106A, Exec. Summary, 1975, p. 95)

It is also necessary at this time to make sure that the instructors and other key personnel are adequately trained in the techniques and procedures with which they are not familiar. The emphasis is on assuring that qualified people

are at the right place at the right time, that they know what they are supposed to do, and they have the materials, equipment, facilities and other resources necessary to do it. (NAVEDTRA 106A, Phase IV & V, 1975, p. 1)

Complete training program capability, consisting of learning objectives, criterion referenced tests, instructional materials, instructional management plan, a trained staff, and adequate facilities, equipment, tools and supplies should now be available. What remains to be done is to conduct instruction in accordance with the procedures and documentation contained in the instructional management plan.

In addition to carrying out their other activities, instructors will keep records and collect data which is useful in evaluating the training program. Among the records kept are: test results and trainee performance for each learning objective; instructor comments on trainees; time requirements for instruction and testing; and enrollment, attendance, attrition and scheduling data. A log is also maintained in which problems encountered with instructional materials, media and people associated with instruction as well as positive and negative incidents are noted as they arise. All editorial, procedural and content changes that were made must also be documented in order to facilitate a complete and accurate program evaluation.

At the completion of each training cycle, the collected information is made available as part of the internal evaluation in order to improve instruction for succeeding cycles. See Figure 1 where the two-step implementation phase is illustrated.

Phase V, Control

Despite the care taken in each procedural step while developing the training program, it is still necessary to determine the effectiveness of the program operating as a dynamic interrelated entity. The internal and external

evaluation steps in this phase provide the needed information on program effectiveness. By careful analysis of this information, problems can be identified and appropriate adjustments made.[7]

Internal evaluation is based on information obtained within the training activity (internally) and is sometimes called a course review. It seeks to determine if instruction is providing trainees with the necessary knowledge and skills to attain learning objectives. (NAVEDTRA 106A, Exec. Summary, 1975, p. 104) The principal measure of instructional effectiveness is the trainees' performance on criterion referenced progress tests and the post-test. Other measures include instructor performance, trainee and instructor opinions concerning instruction and testing, and the amount of time required to complete each learning objective (time on task).

Training records as well as the notes kept by instructors during the conduct of instruction (step IV.2) provide additional sources of valuable information. This is augmented by a check on the training facilities, equipment, tools and supplies to make sure they are adequate and appropriate, as well as an inspection of instructional materials and training aids to determine their quality and availability.

An examination of how the ISD process itself was carried out is also part of the internal evaluation. The purpose is to identify any procedural omissions and failures to use ISD products. Since the capabilities and performance of trainees and the manner in which instruction is conducted may change over time, internal evaluation is a continuous process.

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[7] To assure objectivity, the internal and external evaluation should be conducted by specialists who are not directly responsible for developing or conducting the training. The more independent and impartial the evaluator is, the more useful the data collected will tend to be.

The external evaluation is conducted to find out whether graduates are performing successfully on the job. It uses job performance as the standard to evaluate proficiency and the adequacy of the training program. In a sense this evaluation revalidates the job analysis, selection of tasks for instruction and job performance measure steps in Phase I.

External feedback is obtained by following recent graduates into the field either physically or by questionnaire. The most reliable, but costly, feedback is gained at the work site by actual observation of the graduates' performance and by interviewing both graduates and supervisors or by administering the job performance measures. Mailed questionnaires provide a valuable and less expensive means for conducting field evaluations. Two types are generally used, one is completed by graduates and the other by their immediate supervisors. (AFP 50-58, Vol. V, 1978, p. 1-3)

The external evaluation should take place when the graduate has been on the job for about one to three months. This timing is important because it takes a while for the graduate to get oriented and acquire a feel for what the job is all about and for the graduate and supervisor to formulate judgments concerning job preparation and performance. If more than three months lapse before the graduate and supervisor are contacted, it becomes somewhat difficult to discriminate between knowledge and skills acquired in training and those acquired on the job. (NAVEDTRA 106A, Phase IV & V, 1975, p. 68) As with internal evaluation, external evaluation is an ongoing process which identifies problems and makes specific recommendations for revisions to instruction.

The final function in the ISD approach is that of maintaining quality control of the instructional program through the process of revision. Since a considerable amount of effort has gone into the design and development of an instructional program, and since revisions involve time, people and money, the

decision about what to revise is based solely on the conclusive findings of internal and external evaluations (steps V.1 and V.2). (NAVEDTRA 106A, Phase IV & V, 1975, p. 88) Generally, revision means those changes and improvements made in the procedures, techniques and materials in the training program. The emphasis is usually on change of technique rather than of content, doctrine, or curriculum. (NAVEDTRA 110, 1978, p. 225)

The evaluation and quality control steps of Phase V complete the ISD feedback and interaction process, thereby forming the closed loop instructional system shown in Figure 1. Continual evaluation and quality control are necessary to ensure that instruction is efficiently and effectively conducted to meet job requirements.

Summation

Today, more than ever, vocational training programs must be effective because they are being held accountable. Programs can no longer reflect an individual's "idea" of what should be taught and how the training should be organized and delivered.

The search for an approach with increased likelihood for providing training adequate to meet job performance requirements has resulted in the advancement of ISD. This is because the iterative and derivative character of ISD methodology virtually assures that instruction will meet job requirements when its procedures are conscientiously carried out. These procedures are demanding and time consuming, however, Consequently, ISD will be worth the cost and effort only to the extent that it is implemented so as to realize its full potential.

The extent to which some will adhere to the ISD process and actually use its products in designing training is subject to question. In practice, steps are omitted at times and the close connection between components, that

is essential to make the process truly derivative, is not maintained. Most important, the testing and revision necessary to ensure job relevance generally do not occur. When this happens, ISD becomes a paper exercise. Efforts to implement ISD should therefore attend to the integrity of the model by guarding against omissions in the process and failure to use its various products.

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APPENDIX A

Glossary

GLOSSARY

It is the aim of this alphabetical glossary to provide a source for arriving at some common understanding of terminology which will facilitate more exacting communication.

ABSOLUTE STANDARDS: A statement defining the exact level of performance required of a student as a demonstration that he has mastered the course objective(s). Criterion-referenced tests are usually based on an absolute standard.

ACHIEVEMENT GROUPING: Arrangement whereby students are assigned to groups according to their performance on pretests of units of the course.

ACTION VERBS: Verbs that convey action and reflect the type of learning that is to occur. Action verbs must reflect behaviors that are measurable, observable, verifiable and reliable.

ASSESSMENT: A judgment of the effectiveness and efficiency of a training system, in terms of measurement and evaluation.

ATTITUDE: A persisting state of a person that influences his choice of action.

AUDIOVISUAL AID: Any static or dynamic demonstrative training aid utilized to facilitate and reinforce learning through one or both of the physical senses of sight and hearing.

AUDIOVISUAL EQUIPMENT: Equipment used for the recording, production, processing and exhibition of audiovisual products.

AUDIOVISUAL MEDIA: Refers to any media such as videotapes or film which is both seen and heard.

BASELINE DATA: Valid and reliable information about the current level of performance of the intended student population. This data can be used to confirm the need to develop new instruction, or can be used as a comparison in ascertaining differences between students' performance before and after instruction.

BEHAVIOR: A student's visible action, performance, operation or product which can be classified or labeled by an observer according to specific and discreet criteria.

CONDITIONS:	Occurs in terminal objectives; describes what is presented to the student in order to accomplish the specified action, that is, it describes the important aspects of the performance environment.
COURSE DOCUMENTATION:	Information describing the current content of a course (instructional materials, tests, instructor's manual, evaluation plan, student's manual) and its developmental history (job analysis, criteria for selecting tasks for training, previous revisions).
COURSE OBJECTIVE:	A description of the ultimate purpose of the course, including a statement of who is to be trained, what he is to be trained to do, the degree of qualification brought about by the training, and where and under what general conditions the graduate will perform on the job.
CRITERION-REFERENCED TEST:	Measures what an individual can do or knows, compared to what he must be able to do or must know in order to successfully perform a task. Here an individual's performance is compared to external criteria or performance standards which are derived from an analysis of what is required to do a particular task.
CRITICAL SEQUENCE:	Sequencing of topics or objectives according to their importance.
DATA:	Collection of facts or numerical values resulting from observations of situations, objects, or people.
ENABLING OBJECTIVE:	A three-part objective that helps the student achieve a terminal objective. It describes the behavioral actions, the performance conditions, and the attainment standard expected of the student when he completes the task.
ENTRY BEHAVIOR:	The skill, knowledge and/or attitude required before beginning a new segment of instruction; also may refer to the capability a person has prior to new learning.
ENTRY SKILLS:	Specific, measurable behaviors that have been determined through the process of analysis of learning requirements to be basic to subsequent knowledge or skill in the course.

ENTRY SKILLS TEST:	A measurement instrument designed to determine if a student already possesses certain skills or knowledge needed as a prerequisite before undertaking new instruction.
ENTRY TEST:	Contains items based on the objectives that the intended students must have mastered in order to begin the course.
EVALUATION:	The process of interpreting the results of measurement data (e.g., tests, JPMs) for the purpose of making a judgment or decision on the instruction or on the success of a trainee.
EVALUATION PLAN:	A method or outline of what set of procedures will be used to gather data and information for the purpose of assessing a course of instruction.
FEEDBACK:	The return of information. Information on student performance is "fed" back to the student so that he can improve that performance; to the instructional designer so that he can improve the materials and procedures on the basis of student needs; to the management system so it can monitor the internal and external integrity of the instruction and make appropriate revisions. Or, refers to the flow of data or information from one step in the ISD Model to others.
FOLLOW-UP ACTIVITIES:	The work events that occur after a course of instruction has been completed.
FORMATIVE EVALUATION:	The iterative process of developing and improving instructional materials and procedures.
FRONT END ANALYSIS:	Refers to job analysis, selection of tasks for training, development of JPMs.
GO NO-GO:	Pass-fail; criterion of evaluation whereby student cannot be "partially correct". He is either 100% correct (go) or incorrect (no-go).
INDEPENDENT RELATIONSHIP:	Occurs when skills and knowledges in one objective are unrelated to those in the other objective. Mastering one of the objectives does not simplify the other.

INDIVIDUALIZED INSTRUCTION:	Refers, in the ISD Model, to a management scheme which permits individual characteristics of trainees to be a major determinant of the kind and amount of instruction given. Here, it nearly always implies some form of self-pacing.
INSTRUCTIONAL STRATEGIES:	Methods of presentation, practice and evaluation specifying the ways in which the desired learning outcomes are to be achieved in the instructional setting (e.g., tutorial, lecture/discussion, demonstration, etc.).
INSTRUCTIONAL UNIT:	An assembly of lessons which have been integrated, either to complete a usable bit of knowledge or skill, or to aid in scheduling a course or program. The basic components of courses. Same as "Unit of Instruction."
INTERNAL EVALUATION:	Assessment of the effectiveness of an instructional program in terms of student performance and stated terminal objectives.
JOB:	The duties and tasks performed by a single worker constitute his job. If identical duties and tasks are performed by several individuals, they all hold the same job. The job is the basic unit used in carrying out the personnel actions of selection, training, classification, and assignment.
JOB ANALYSIS:	The basic method used to obtain a detailed listing of duties, tasks, and elements necessary to perform a clearly defined, specific job, involving observations of workers and conversations with those who know the job, in order to describe in detail the work involved, including conditions and standards.
JOB PERFORMANCE MEASURES:	Tests that are used to evaluate task proficiency under actual work conditions and standards.
JOB SHEET:	An instruction sheet which provides for the individual student a list of the principal steps to be taken in doing a job in the order in which they are to be done. Job sheets also provide the student with the objective(s) to be accomplished and list the references, equipment, and materials required.
KNOWLEDGE:	Specified information or facts required to develop the skills and desired attitudes to effectively accomplish prescribed jobs, duties and tasks.

LEARNER CHARACTERISTICS:	The traits possessed by learners that could affect their ability to learn (e.g., age, I.Q., reading level, etc.).
LEARNING ANALYSIS:	A procedure to identify subelements that must be learned before a person can achieve mastery of the performance.
LEARNING CATEGORY:	A division of learning behavior. All learning may be classified into one of four learning categories: mental skill, physical skill, information, or attitude.
LEARNING HIERARCHY:	Graphically portrays the relationships among learning tasks in which some tasks must be mastered before others can be learned.
LEARNING STEP:	Occurs when enabling objectives are broken down into smaller parts.
LESSON GUIDE:	An organized outline of a single lesson topic taken from the course of study and serving as a blueprint of what is to be accomplished in class. It is complete in detail and states all objectives, topics, subtopics, references, training aids, methods, procedures, and other supplemental information as needed. In general, the lesson guide is the formal lesson plan.
MANAGEMENT PLAN:	Program for the assignment, monitoring, and assessment of the personnel, materials and resources dedicated to a specific mission, operation, or function.
MASTERY:	In terms of learning, refers to meeting all of the specified minimum requirements for a specific performance. Criteria for mastery are defined in the design phase of the ISD Model.
METHODS:	The means, techniques, procedures, etc., of instruction. There are many methods appropriate for use. Included may be such processes as lecture, recitation, practical application, examination, study periods, demonstrations, use of training aids, group discussions, reviews, demonstration-performance, panel discussions, role playing, case studies, craftsman, programmed instruction, and coach and pupil methods.

MEDIA:	Means for presenting instructional material to learners; for example, books, audiotapes, and filmstrips.
MEDIA SELECTION:	Is the major means of determining how instruction is to be packaged and presented to the student.
MODULE:	An individualized self-instructional package usually containing all the necessary materials a learner needs to meet some or part of a terminal objective.
MULTIMEDIA PACKAGE:	Self-contained instructional unit in more than one medium.
ON-THE-JOB-TRAINING (OJT):	A program of training designed specifically to train an individual, without the necessity for interrupting his performance of daily assigned duties relative to his work assignment. OJT programs may range in complexity from those designed to train an entry level student to become fully qualified in the case of simple tasks, to programs designed to take an individual who possesses the fundamental principles required to understand the tasks from this level to that of an individual who is fully qualified to perform all the tasks and duties of his position without assistance.
OVERLEARNING:	Refers to the continual practice on a learning task by a person who has correctly performed the task.
PEER TUTORING:	A form of instruction in which students at the same or more advanced level of knowledge provide instruction to students at the same or lower level of knowledge on the specific objectives under consideration.
PERFORMANCE MEASURES:	The absolute standard by which a job performance is judged. A performance measure is the inventory of job tasks with each performance objective.
PERFORMANCE TEST:	A sample work situation in which personnel being tested perform a practical task which requires them to demonstrate how well they have mastered the skills required for the performance of their job. For some circumstances this could be a written test if designed as a job sample for personnel whose responsibilities involve only paper procedures.

POST-TEST:	A test administered after the completion of instruction to assess whether a student has mastered the objectives of the course or unit.
PRE-TEST:	Administered prior to instruction to determine how much the student already knows.
PROGRESS TESTS:	Short examinations administered daily or weekly throughout the course to evaluate student progress.
QUALITY CONTROL:	Process of measuring and evaluating in order to maintain course standards through adjustments in instructional materials or procedures.
RELIABILITY:	The consistency with which a test measures the amount of student achievement.
SAMPLE:	A portion or small segment of the students for whom instruction is designed.
SELF PACING:	Mode of instruction whereby each student works through the instructional materials at his own rate of speed.
SEQUENCING:	Ordering instruction; proper sequencing allows the learner to make the transition from one skill or body of knowledge to another, and assures that supporting skills and knowledge are acquired before dependent performances are introduced.
SKILL:	The ability to perform a job-related activity which contributes to the effective performance of a task.
STANDARDS:	Occurs in terminal and enabling objectives; describes the criterion or standard of performance which must be attained.
SUBJECT MATTER EXPERT:	A person who has professional skill in the performance of some job and who is consulted by an instructional designer in the process of job task analysis.
SYSTEMS APPROACH:	A generic term referring to the orderly process of analysis, design, development, evaluation, revision, and operation of a collection of interrelated elements.

TARGET POPULATION:	The pool of potential entrants to training for which instructional materials are designed and tried out.
TERMINAL OBJECTIVE:	A three-part objective expressed in terms of and keyed to tasks as listed in the Training Analysis Summary that helps the student achieve the course objective. It describes the behavioral actions, the performance conditions, and the attainment standard expected of the student when he completes the task.
TRADE-OFFS:	In any systematic approach to instruction, it is necessary to make compromises between what is desirable and what is possible. Ordinarily, these decisions involve increases or decreases in time, money, facilities, equipment, or personnel. Training aids and simulators represent examples of trade-offs.
TRAINING ANALYSIS:	A process for proceeding from an inventory of tasks, such as that provided by a job task analysis, to an organized set of course, terminal, and enabling objectives.
TRYOUT:	Practice test; the purpose is to make the tryout as realistic as possible by eliminating as many sources of unreliability as possible.
UNDERTRAIN:	Provide inadequate training that does not prepare a student to meet regular job performance requirements.
VALIDATION:	A process through which a course is revised until it is effective in realizing its instructional goal.
VALIDATION PROCESS:	Testing instructional materials on a sample of the target population to insure that the materials are effective.
VALIDITY:	The degree to which a test measures what it claims to measure.
WRITTEN TEST:	A test in which an individual demonstrates his capabilities by written techniques. Not usually a performance test, and hence is usually a measure of supporting knowledge rather than skills.

APPENDIX B

Job Performance Measure

JOB TITLE _____ TASK NO. _____

TASK STATEMENT (Behavioral actions to be taken):

_____

_____

_____

A. PERFORMANCE CONDITIONS (Identify those conditions under which the test is to be administered that would make a difference in performance):

1. SETTING: _____

2. ( ) ACTUAL EQUIPMENT (TASK OBJECT) UNDER ACTUAL WORK CONDITIONS

( ) ACTUAL EQUIPMENT (TASK OBJECT) UNDER SIMULATED WORK CONDITIONS

( ) SIMULATOR

EQUIPMENT, SIMULATOR, MOCKUP, OR SIMULATED MATERIALS TO BE PROVIDED:

_____

3. PERSONNEL: _____

4. REFERENCES: _____

5. TOOLS: _____

6. SUPPORT MATERIALS: _____

7. SUPPORT EQUIPMENT: _____

8. TEST EQUIPMENT: _____

9. OTHER: _____

B. ATTAINMENT STANDARDS (a measure of the adequacy of performance):

1. 100% OF ALL CRITICAL SCORABLE CHARACTERISTICS/TASKS ELEMENTS.

2. ___% OF ALL NONCRITICAL SCORABLE CHARACTERISTICS/TASK ELEMENTS.

3. WITHIN _____ TIME. (time limit)

4. OTHER: _____

C. ADMINISTRATIVE DIRECTIONS:

1. DIRECTIONS TO TRAINEE: _____

_____

_____

_____

2. SCORING PROCEDURES: _____

_____

D. JOB PERFORMANCE MEASURE CHECKLIST (Label TASK ELEMENTS listed below with an (S) or (C) symbol as appropriate):

(S) SEQUENCE IS IMPORTANT. THIS STEP MUST BE PERFORMED ONLY AFTER THE PRECEDING STEP(S).

(C) CRITICAL STEP. FAILURE TO MEET STANDARDS FOR THIS ITEM CONSTITUTES FAILURE OF THE JOB PERFORMANCE MEASURE.

1. PROCESS: _____

_____

TASK ELEMENTS	STANDARDS

2. PRODUCT:

SCORABLE CHARACTERISTICS	STANDARDS

APPENDIX C

Learning Objective Analysis Worksheet

LEARNING OBJECTIVE ANALYSIS WORKSHEET

COURSE	UNIT/MODULE	LESSON TOPIC	TASK I.D. NUMBER	PAGE NO.
Fill out one version only. ☐ TERMINAL	TERMINAL OBJECTIVE NO.	JPM NO.	ENABLING OBJECTIVE NOS. THAT SUPPORT THE TERMINAL OBJECTIVE	
☐ ENABLING	ENABLING OBJECTIVE NO.	TERMINAL OBJECTIVE NO. THE ENABLING OBJECTIVE SUPPORTS		

LEARNING OBJECTIVE ACTION STATEMENT

CONDITION

STANDARD

LEARNING CATEGORY

TEST ITEMS

MEDIA SELECTION

EQUIPMENT REQUIRED FOR PERFORMANCE OF OBJECTIVE

EXISTING MATERIALS SELECTED

☐ YES ☐ NO *If YES, outline below.*

APPENDIX D

Glossary of Action Verbs

GLOSSARY OF ACTION VERBS

Action verbs describe the behavior or action a trainee will perform to demonstrate attainment of the learning objective. The verb used should reflect actions that are measurable, observable, verifiable, and reliable (not prone to varying interpretation) in order to reduce ambiguity. Verbs such as "appreciate", "understand", "know", "study", "familiarize", "be aware of", "become acquainted", and "discuss" are vague and do not express measurable performance. The following is an alphabetical glossary of selected action verbs.

ACCEPT: Receive with consent; e.g., accept international mail.

ACKNOWLEDGE: Report receipt of a letter, check, supplies, etc.

ACTIVATE: Make active; e.g., activate storage batteries.

ADJUST: Fit to meet regulations or requirements.

ALIGN: Adjust, form, or bring to, a line.

ALTER: Resew garments for better fit; reshape metal.

ANNEAL: Subject to high heat, with subsequent controlled cooling, for the purpose of softening thoroughly and rendering less brittle; e.g., anneal gravers, springs and screwdriver bits.

ANSWER: Act or reply in response to an action performed elsewhere or by another; e.g., answer verbal inquiries concerning routine mail service.

APPLY: Put to use; e.g., apply flux to a joint to be soldered.

APPROVE: Give official sanction to; e.g., approve proposed plans and procedures.

ARRANGE: Put in order; adapt; e.g., (a musical composition) by scoring for voices or instruments other than those for which originally written; e.g., arrange classroom for instruction.

ASSEMBLE: Put together into a unit from parts or subassemblies; e.g., assemble usage and inventory data.

ASSIGN: Specify, select, or designate; e.g., assign responsibilities to supervisory personnel.

ASSIST:	Aid, help, support - as regular part of duties, as requested, required or initiated; e.g., assist dentist while treating patients.
ATTACH:	Connect; fasten.
AUTHENTICATE:	Prove authentic, confirm, verify as to genuineness; e.g., authenticate the driver's license.
BLEED:	Drain or empty of liquid, gas, or other contents; e.g., bleed a steam cylinder.
BRAZE:	Solder with a relatively infusible alloy.
BUILD UP:	Replace worn material in order to return (an article) to original dimension or thickness.
CALIBRATE:	Determine, rectify, or mark the gradations of a quantitative measuring instrument; adjust in accordance with a previously defined standard.
CANCEL:	Mark for deletion.
CARVE:	Cut and serve meat; wood carving, etc.
CASH:	Pay or obtain cash for.
CHANGE:	Replace with another; e.g., change typewriter ribbons.
CHECK:	Inspect for satisfactory condition, accuracy, safety, or performance; e.g., check overhaul schedules for conformity with maintenance program.
CLASSIFY:	Place in categories, as personnel, duty positions, supplies, etc.
CLEAN:	Rid of dirt, impurities, or extraneous matter.
COLLECT:	Gather together, assemble, accumulate, compile; e.g., collect data on structure and functionings of organizations.
COMMUNICATE:	Give, or give and receive, information, signals, or messages in any way, as by speech, gestures, writing, etc.
COMPACT:	Pack together by vibration or rodding.

COMPARE:	Examine for likenesses and/or differences; e.g., compare performance with established standards.
COMPILE:	Collect into proper or designated form; e.g., compile data into a report.
COMPLETE:	Provide with lacking parts or information; e.g., complete inspection sheets.
COMPLY:	Conform to guidelines previously established.
COMPOSE:	Put together or create, as a letter or a musical work.
COMPUTE:	Determine by mathematical processes; e.g., compute vacation and sick leave credits.
CONSTRUCT:	Put together systematically; e.g., construct tests for measuring achievement.
CORRECT:	Make or set right; alter or adjust to bring to a required condition; rectify; indicate and eliminate errors, faults, discrepancies to be amended.
CROP:	Remove the upper or outer parts of; e.g., crop pictures for newspaper reproduction.
CURE:	Treat to prevent sudden loss of moisture from concrete by using water, wet sand, or straw; medical application; food aging process.
CUT:	Make or fashion by cutting; e.g., cut with a gas cutting torch or shears.
DEENERGIZE:	Remove energy from.
DEFINE:	Determine and express the essential qualities or precise meaning of.
DEHYDRATE:	Remove water from; e.g., dehydrate a refrigeration system.
DESIGN:	Plan or sketch a pattern or outline for; e.g., design cards and report forms.
DETAIL:	Furnish with the smaller elements of design or finish; e.g., detail a drawing.

DETECT:	Discover the presence or existence of something previously hidden or unclear.
DEVELOP:	Unfold more completely, evolve the possibilities of (something latent), advance, further, promote the growth of; unfold gradually, form or expand by a process of growth; make more available or usable.
DIAGNOSE:	Recognize, analyze and identify (usually a disease) any condition, state or situation by examination and observation.
DIFFERENTIATE:	Perceive or express the difference; distinguish between.
DIRECT:	Regulate the activities or course of; control; guide; give an order or instruction to.
DISASSEMBLE:	Break down, take apart; e.g., disassemble an electrical generator, or a differential pressure gauge.
DISTINGUISH:	Recognize or discriminate one thing from another; perceive clearly; e.g., distinguish between shapes.
DISTRIBUTE:	Divide, deal out, portion; e.g., distribute incoming mail.
DRAFT:	Make a preliminary sketch or composition of; e.g., draft a letter.
DRAIN:	Draw off (liquid) gradually or completely.
DRAW:	Create a likeness or picture in outlines; sketch.
DRY:	Free of water or liquid.
DUST:	Sprinkle with fine particles; to remove dust from by wiping.
EDIT:	Revise and make ready for publication; assemble (as a motion picture) by cutting and rearranging.
ENERGIZE:	Give energy to, activate; switch on.
ENFORCE:	Compel observation of or compliance with, such as a regulation, rule, policy, procedures; e.g., enforce safety regulations and procedures.

ENSURE:	Make sure, certain, and inevitable; make sure of; e.g., ensure maximum care of patients.
EQUIP:	Furnish for service; fit out; supply with what is necessary for efficient action.
ERECT:	Build; set up; establish.
ESTABLISH:	Institute; bring into existence.
ESTIMATE:	Form a judgment about; gauge; determine or calculate approximately; e.g., estimate the need for supplies and equipment.
EVALUATE:	Determine value or worth of, appraise; e.g., evaluate inspection forms, work orders, and discrepancy reports.
EXAMINE:	Scrutinize to determine nature, condition, or quality of.
EXERCISE:	Put into action, use, employ; practice, activate for the purpose of training or developing; exert, wield, or have (influence, control, authority); e.g., exercises control over departmental publications.
FABRICATE:	Construct by assembling standard parts or sections; e.g., fabricate elementary designs.
FILE:	Lay away documents, papers, etc., in a methodical manner; set in order.
FIT:	Adjust to a required form and size; e.g., fit doors and windows.
FLUSH:	Pour liquid over or through, especially to wash out with a rush of liquid.
FORECAST:	Predict; indicate as likely to occur.
FORMULATE:	Express or put in systemized statement; e.g., formulate plans, policies, procedures, etc.
FORWARD:	Transmit; send onward, as a report, through channels.
HANDLE:	Manage, control, direct, deal with, perform a function with regard to, treat, manipulate; e.g., handle manila or wire rope.

HARDEN:	Indurate; make hard; e.g., harden gravers, springs, and screwdriver bits.
IDENTIFY:	Establish the identity of; distinguish; discriminate.
IMPLEMENT:	Accomplish, fulfill, carry out, put into effect; e.g., implement plans and policies.
INDOCTRINATE:	Instruct in rudiments or principles of.
INFORM:	Give knowledge to; tell; acquaint with a fact; notify.
INSPECT:	Look at carefully; examine critically; examine or review officially; e.g., inspect commutator segments and brushes for alignment.
INSTALL:	Set up or fix for use or service; establish in a place; e.g., install a car radio.
INSTRUCT:	Impart knowledge systematically; inform; furnish with directions; direct or command; train or indoctrinate.
INTERVIEW:	Consult formally with (usually implies questioning or obtaining information); e.g., interview witness.
INVENTORY:	Prepare an itemized account of goods or stock, usually at regular intervals and sometimes including the worth of the items listed; e.g., inventory allowed materials.
ISSUE:	Give out officially, as supplies, and equipment.
JOIN:	Connect; link together.
LOCALIZE:	Determine the origin or place of, as an organic or mechanical malfunction; to confine or restrain to a particular area.
LOCATE:	Designate the site or place of, define the limits of; e.g., locate drainage valves.
LUBRICATE:	Make slippery; apply a lubricant to.
MAINTAIN:	Hold or keep in a state or condition, especially in a state of efficiency, newness, validity, or cleanliness.
MANUFACTURE:	Make by hand, machinery, or other agency; work into suitable form for use; fabricate; e.g., manufacture reinforced concrete block.

MARK:	Affix a significant identification to; indicate by marks or symbols.
MEASURE:	Ascertain the extent, degree, quantity, dimensions or capacity of, by a standard; e.g., measure radar ringtime.
MIX:	Combine or blend into one mass; e.g., mix paint or concrete.
OBSERVE:	Pay special attention to.
OBTAIN:	Procure, get possession of; e.g., obtain data for inclusion in a rough deck log.
OPERATE:	Cause to function; run or control the functioning of; e.g., operate a machine tool.
ORGANIZE:	Arrange; systematize persons or things into proper places, especially in relation to each other.
OVERHAUL:	Examine thoroughly, checking for needed repairs and making repairs and adjustments needed to restore working order; e.g., overhaul generating and control equipment.
PACKAGE:	Wrap or box as for selling, carrying, disposing, or storage; e.g., package items for shipping.
PATCH:	Mend, repair, strengthen, etc., with a patch or overlay; e.g., patch lacerations, abrasions and punctures on inflatable boats.
PERFORM:	Carry out or execute some action.
PLACE:	Position; set in a particular place; e.g., place concrete.
POSITION:	Put in proper place.
POST:	Transfer or carry from one record to another.
PREPARE:	Make ready; put into a state for use or application; e.g., prepare a request for supplies.
PRESENT:	Offer for consideration or view; e.g., present findings of an investigation; present school policy to the press.
PRESERVE:	Keep from harm, damage, danger, evil, etc.

PRINT:	Letter; write in letters shaped like those of ordinary roman text type.
PROCESS:	Subject to a special treatment; e.g., process photographic film.
PROOFREAD:	Read and mark corrections in (a proof).
PURGE:	Cleanse or rid of impurities, foreign matter, or undesirable elements; e.g., purge air from air conditioning systems.
RE.CTIVATE:	Make active again.
READ:	Interpret, comprehend the meaning of, learn or get knowledge from; e.g., read printed or written characters, as of words or music.
REASSEMBLE:	Refit together the parts of.
RECEIVE:	Accept delivery of something; e.g., receive surplus material for disposal.
RECORD:	Write, enter, or register for purpose of evidence or reproduction; e.g., record data in a chronometer record book.
REFINISH:	Give a new surface to.
REMOVE:	Change the location of by taking off, out of, or away from.
REPAIR:	Restore to working condition, as equipment, at field or higher echelon maintenance; e.g., repair radio headsets and microphones.
REPLACE:	Supply an equivalent for; e.g., replace light bulbs.
REPLENISH:	Fill up again; replace.
REQUISITION:	Make a formal request, application or written order, as for equipment, tools, paper, food, supplies; e.g., requisition allowed materials.
RESUME:	Begin again after interruption.
REVISE:	Look at or over again and correct or improve.

REWRITE:	Put into form for publication.
RIG:	Furnish or provide with equipment; e.g., rig with wire rope.
ROUTE:	Fix the order of procedure in a series of operations; e.g., route correspondence.
SANITIZE:	Make sanitary (as by cleaning or sterilizing).
SCALE:	A system of ordered marks at fixed intervals used as a reference standard in measurement.
SCHEDULE:	Designate fixed times for accomplishment of, as training programs, mail deliveries, courier service, etc.
SCORE:	Determine the merit of; grade.
SCREEN:	Examine, usually methodically, in order to separate into different groups.
SEARCH:	Look for, hunt through, examine, explore, inquire, scrutinize.
SECURE:	Make safe, firm, fast, or tight.
SELECT:	Take by preference from among others; e.g., select portable power tools.
SELL:	Give up something for money or other valuable consideration.
SEND:	Dispatch by some means of communication, as by mail or telegraph.
SERVICE:	Provide minor maintenance such as supply automobile with gas, oil, and air.
SHARPEN:	Make sharp.
SHAVE:	Sever the hair from close to the skin with a razor.
SOLDER:	Join with solder; e.g., solder pipe fittings.
SOLVE:	Determine answers to problems; e.g., solve mathematical problems.

SORT:	Arrange according to characteristics.
SPEAK:	Articulate sounds with the ordinary voice; talk; enunciate.
SPELL:	Name, write, or print the letters of - in order.
SPLICE:	Join or unite (rope and wires) by weaving together the end strands; e.g., splice rope.
START:	Begin; cause to move or operate; e.g., start ECM equipment.
STEER:	Set and hold a course; guide by mechanical means; e.g., steer ship in restricted waters.
STERILIZE:	Free from living germs; e.g., sterilize dental instruments.
STOP:	Cause to cease; arrest the progress or motion of; e.g., stop IFF equipment.
STORE:	Deposit in a place (as a warehouse) for preservation and/or security.
STRAIGHTEN:	Make straight in direction, form, position.
STRIP:	Remove extraneous or superficial matter from.
SUBMIT:	Present or refer to others for decision or consideration; e.g., submit reports, proposals, estimates, etc.
TAG:	Supply with identifying marker; e.g., tag valves.
TEMPER:	Bring (steel, glass, or the like) to a degree of hardness and toughness; e.g., temper gravers and springs.
TEST:	Examine critically or try out material.
TIE:	Attach; make a bond or connection; fasten; e.g., tie a bowline on a bight.
TRACE:	Follow the path, development, process or history of.
TRACK:	Follow the course of; trace by means of such evidence as radar blips and solar echoes.

TRAIN:	Form or impart proficiency by teaching drilling, instructing, discipline, etc.
TRANSCRIBE:	Translate data or information from one recording form to another.
TRANSFER:	Convey from one place, person or thing to another.
TRANSPORT:	Carry from one place to another, especially over relatively long distances; e.g., transport an injured person by fireman's lift.
TREAT:	Act upon with some agent, especially to improve or alter; e.g., treat a metal with acid.
TROUBLESHOOT:	Correct, remove, or mitigate or trouble or deleterious condition; e.g., troubleshoot electrical and mechanical control systems.
TRUE:	Fit, place, shape, align, or adjust accurately so as to conform with a standard; e.g., true pressure gauge hairsprings.
TYPE:	Produce visual information by means of a typewriter.
UNLOAD:	Take the cargo from.
UNPACKAGE:	Remove covering from.
USE:	Employ; carry out purpose or action by means of; expend or consume by putting to use; e.g., use electrical and electronic schematics.
VERIFY:	Confirm condition, correctness, status, or level.
WELD:	Unite or fuse pieces of metal by hammering, compression, or the like, especially after rendering soft or pasty by heat, sometimes with the addition of a fusible metal.
WIND:	Tighten the spring of; e.g., wind chronometers.
WIRE:	Use wire on; bind, connect, attach with a wire; e.g., wire shut a valve.
WRITE:	Compose; e.g., write a letter, test items.

APPENDIX E

Training Program Planning Worksheet

TRAINING PROGRAM PLANNING WORKSHEET

GOAL: ACTIVITY/TASK: RESULT:	REMARKS/CONSTRAINTS

GOAL: ACTIVITY/TASK: RESULT:	REMARKS/CONSTRAINTS

GOAL: ACTIVITY/TASK: RESULT:	REMARKS/CONSTRAINTS

APPENDIX F

Guide for Evaluation of Instruction

GUIDE FOR EVALUATION OF INSTRUCTION					READ INSTRUCTIONS ON REVERSE BEFORE FILLING IN THIS FORM
INSTRUCTOR:	ELT	BST	PAT	EVALUATOR:	INSTRUCTOR'S INITIALS
TIME: DATE:	CLASS: SECTION:	TITLE OR NATURE OF LESSON			
ITEM		IN THE SPACE BELOW, WRITE COMMENTS PERTINENT TO THE EVALUATION. USE THE OTHER SIDE OF FORM FOR ADDITIONAL COMMENTS.			
INTRODUCTION: 1. CONTENT A. TOPIC DISPLAYED B. OBJECTIVES STATED C. VALUE TO STUDENT 2. EFFECT					
PRESENTATION: 1. KNOWLEDGE OF THE SUBJECT MATTER 2. ORGANIZATION AND COVERAGE A. FOLLOWS LESSON PLAN B. LESSON COMPLETED 3. TELLING PROCEDURES A. LOGICAL SEQUENCE B. NOMENCLATURE COVERED C. CLEARLY EXPLAINED 4. SHOWING PROCEDURES A. ALL SEE EQUIPMENT B. OPERATIONS SHOWN 5. DOING PROCEDURES					
TRAINING AIDS: 1. USED APPROVED TRAINING AIDS 2. DISPLAYED PROPERLY 3. STRENGTHENED INSTRUCTION					
APPLICATION: 1. DIRECTIONS 2. INTERACTION 3. CORRECTION OF STUDENT ERRORS 4. SAFETY					
SUMMARY: 1. EFFECTIVE COVERAGE BY: A. TELLING, QUESTIONING, ETC. 2. NO NEW MATERIAL					
ASSIGNMENT. 1. SPECIFIC, ORAL AND VISUAL 2. DUE DATE					
INSTRUCTIONAL MATERIALS: 1. USE OF INSTRUCTOR GUIDE 2. FOLLOW OBJECTIVES 3. USE OF STUDENT GUIDE					
QUESTIONING: 1. PROPER TECHNIQUE (QUALITY AND QUANTITY)					
INSTRUCTOR CHARACTERISTICS: 1. VOICE 2. LEADERSHIP (CONTROL OF CLASS) 3. ENTHUSIASM 4. APPEARANCE 5. MANNERISMS					
PHYSICAL CONDITIONS: 1. HEAT, LIGHT, VENTILATION 2. ARRANGEMENT, SEATS					
GENERAL EVALUATION OF INSTRUCTOR, MARK ONE: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 KEY ON REVERSE SIDE OF FORM					

GUIDE FOR EVALUATION OF INSTRUCTION

This guide is designed to assist both the evaluator and the instructor in improving instruction. They should discuss the notes made on it soon after the observed lesson. The relationship between the instructor and the evaluator must be one of understanding and cooperation in which both work to reach the same goal of obtaining the best instruction possible. Use the following procedures for observation and improvement:

1. Make advance arrangements with the instructor to assure observation of a typical lesson. Advise the instructor that the purpose of the visit is to assist in the improvement of instruction, not to participate in the class work.
2. Inform yourself about the instructor, trainees, and the work underway.
3. Arrive before the class starts. Locate a suitable place for observation. If late, enter and locate yourself as quickly and inconspicuously as possible.
4. Observe the entire lesson. Avoid being conspicuous when taking notes.
5. Use the items in the left hand column for the evaluation of the lesson presentation. Evaluate all applicable items: enter meaningful comments rather than grades or single words. Make suggestions for the improvement of weak areas and commend the instructor on the strong points of instruction. An over-all evaluation should be given on the basis of the five point scale below.
6. Provide the instructor with a completed copy of the evaluation guide.
7. Maintain a file of evaluation guides for each instructor for use in determining the extent of his improvement.

ADDITIONAL COMMENTS FROM THE OTHER SIDE OF GUIDE:

KEY: 1 : UNSATISFACTORY 2 : NEEDS IMPROVEMENT 3 : SATISFACTORY 4 : EXCELLENT 5 : OUTSTANDING